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November 10, 2020

Ms. Nicole Krueger, Wastewater Engineer
Wisconsin Department of Natural Resources
Milwaukee Service Center
2300 North Dr Martin Luther King Jr Drive
Milwaukee, WI 53212-3128
C: Nicole.Krueger@wisconsin.gov

RE: Freedom Sanitary District No. 1
Dissipative Cooling: November 2020 Temperature and Conductivity Monitoring

Dear Ms. Krueger:

This letter is intended to fulfill your request from June 30, 2020, regarding the collection of an additional temperature and conductivity monitoring profile regarding Freedom Sanitary District No. 1's Dissipative Cooling Request.

Background:

Freedom Sanitary District has previously submitted a Dissipative Cooling Request Study to the Wisconsin Department of Natural Resources (WDNR) in July 2019 and additional data regarding the Dissipative Cooling Request in June 2020. In-stream measurements collected from previous submittals suggested that there was a lack of significant thermal impact on Duck Creek water temperature due to contribution from the Sanitary District's WWTP outfall.

The WDNR has requested additional data collected laterally across the stream and at various depths during conditions representative of the annual October – December period, for which the Sanitary District's effluent temperature limits would be effective. The additional in-stream temperature and conductivity data was collected during one single-day monitoring period on November 3, 2020.

On the attached Figure 1, the approximate locations for all sampling points are identified. In general, the monitoring locations match the locations used for data collection in previous studies. The monitoring locations used for the additional data collection are:

- Location 1: Located approximately 50 linear feet (LF) upstream of WWTP outfall.
- Location 2: WWTP outfall.
- Location 3: Located approximately 50 LF downstream of WWTP outfall.
- Location 4: Located approximately 75 LF downstream of WWTP outfall.
- Location 5: Located approximately 125 LF downstream of WWTP outfall.

At the monitoring locations, temperature and conductivity measurements were obtained at the water surface and near the bottom of the water column (top of bedrock).

Measurements were taken in the middle of the stream, and approximately five (5) feet from the streambank on either side of the creek at each of the monitoring locations. For reference, the WWTP outfall discharges effluent into the "East Bank" of Duck Creek.

For each lateral stream measurement point, a surface reading was obtained from directly below the water level, and an additional measurement was obtained just above the sediment. For several monitoring points, the water column was only three (3) inches deep or lower, so the surface measurement was also used as the bottom measurement for these locations. Where applicable, this distinction is clarified for presentation of data.

Two additional monitoring points were used to collect data for a small tributary that runs northwest of a small island in the middle of the creek near the WWTP outfall location. According to the WWTP operators, flow has been consistently been observed in this tributary when normal seasonal flow conditions occur in Duck Creek. The additional tributary monitoring points are discussed further during presentation of the collected data.

All raw data collected for the two monitoring periods is provided as Attachment 1 to this letter.

The notations used to indicate a respective monitoring point include:

- **E** – East Bank measurement.
- **M** – Middle of Creek measurement.
- **W** – West Bank measurement.
- **S** – Surface measurement.
- **B** – Bottom of Creek measurement.

Surface and bottom of creek temperature and conductivity profiles are discussed for the monitoring period below.

November 3, 2020, Monitoring Period – General Information:

The measured water surface temperature and conductivity profiles are shown on the attached Figure 2, and bottom of creek measurements are shown on Figure 3. For this day, the WWTP effluent temperature was measured at 56°F, and ambient air temperature was 42°F. Water surface temperatures for all measurement points ranged from 38.3°F to 46.9°F.

In general, the profiles demonstrate there is impact on in-stream temperature and conductivity from the addition of WWTP outfall. Ambient temperatures are not observed in the creek until approximately 125 LF downstream of the WWTP outfall. Similar temperature and conductivity trends occur for both surface and bottom of creek measurements, though this observation may be influenced by the shallow water column depth on this particular sampling day. Specific measurements taken at various locations in Duck Creek are discussed further below.

Location 1 – 50 LF Upstream Monitoring Point:

The upstream surface temperature and conductivity measurements taken at Location 1 were relatively uniform across the cross section of the creek, with temperature approximately 38.5 °F and conductivity near 1,000 mS/m. On the attached photo log, Photo 1 indicates the approximate location of the Location 1 monitoring points for reference. The water depth at each point at Location 1 was approximately 18 inches, allowing both surface and bottom of creek measurements to be obtained. There was minimal difference between the temperature and conductivity measurements from surface to bottom, though a conductivity difference of nearly 200 mS/m was collected for Point 1-W-S and 1-W-B.

Location 2 – WWTP Outfall Monitoring Point:

Measurements collected at Location 2 indicate an immediate impact of WWTP effluent along the east bank, as noted in prior monitoring profiles. Less impact is observed at central and west bank monitoring points at Location 2, as measurements taken at these points are in-line with respective upstream conditions for both temperature and conductivity. On the attached Photo 2, the dispersion plume from the WWTP outfall flow can be observed near the arrow for Point MP 2-E-S.

Photo 2 and Photo 3 show the monitoring points for Location 2. As noted on the west bank of the creek in the photos, there is a separate tributary of flow that extends around a small island in the middle of the creek. The upstream entrance to this tributary is noted on Photo 2 and Photo 3. This tributary is approximately 125 LF in length and flows to the north east before recombining with creek flowing around the east bank. Temperature and conductivity measurements were collected at the mouth of each side of this tributary to determine if it is impacted by WWTP effluent. The upstream mouth of the tributary is approximately laterally across the creek from the WWTP outfall location. The temperature and conductivity at the upstream mouth surface was 38.7°F and 995 mS/m, in line with upstream measurements.

Location 3 – 50 LF Downstream Monitoring Point:

Photo 4 shows the monitoring points for the cross-section of Duck Creek approximately 50 LF downstream of the WWTP outfall location (Location 3). At Location 3, the water depth at the east bank point was approximately six inches (6”), while the middle and west bank points were less than three inches (3”) deep. Therefore, no bottom of creek measurements were obtained for MP 3-M or MP 3-W.

The data collected at Location 3 indicates the WWTP effluent is impacting nearly the entire lateral section of the creek, as west bank, and middle measurements for both temperature and conductivity increased from previous values. Surface-level east bank temperature and conductivity at Location 3 decreased from the Location 2 values. The bottom temperature measurement at MP 3-E-B increased 0.36°F from the respective Location 2 measurement while conductivity decreased. The separate tributary flows behind the section of land shown behind MP-3-W-S and cannot be seen in Photo 4.

Location 4 & 5 – 75 LF and 125 LF Downstream Monitoring Points:

In Photo 5, measurement locations can be seen for Location 4, Location 5, and the downstream mouth of the northwest tributary. Location 4 is near a shallow section of water that flows over bed rock and causes a drop in the water column, as shown in Photo 5. At Location 4, approximately 75 LF downstream from the WWTP outfall, the temperature and conductivity is still elevated across the lateral section of the Creek from ambient conditions. The water depth at Location 4 is approximately three inches (3") across the section, and no bottom of creek measurements were collected at this location.

The northwestern tributary enters back into the eastern tributary of Duck Creek downstream of Location 4. The temperature and conductivity measurement taken at the downstream mouth of the northwestern tributary were 38.5°F and 1,005 mS/m, indicating a slight reduction from upstream temperature and slight increase in conductivity. The temperature and conductivity measurements taken at the upstream and downstream mouths of the tributary are representative of ambient conditions and indicate this pathway is not impacted by flow from the WWTP outfall.

At Location 5, approximately 125 LF downstream from the WWTP outfall, the monitoring locations in the middle of the Creek section and along the west streambank (Points MP 5-M-S and MP 5-W-S) were measured to return to ambient conditions for both temperature and conductivity. Along the east bank, the temperature and conductivity are still elevated from ambient conditions, similar to the respective measurements collected at Location 3 and Location 4. No bottom of creek measurements were collected for the Location 5 points because the water column was less than three inches (3") deep.

Conclusion:

As shown in the attached photos, there is a clear separation of a northwestern and eastern tributary with active flow in Duck Creek shortly downstream of the WWTP outfall location. The collected data indicates the eastern tributary is impacted by contribution from the WWTP outfall, but the northwestern tributary exhibits ambient conditions at both the upstream and downstream mouths.

We believe the data collected on November 3, 2020, indicates there is a continuous and clear pathway in the northwestern tributary of Duck Creek that fish and aquatic life can utilize which is not impacted by thermal contributions from the WWTP outfall. The central and western portions of the Duck Creek cross-section exhibit ambient temperature and conductivity shortly after the northwestern tributary recombines with the eastern tributary approximately 125 LF downstream of the WWTP outfall location, suggesting the ambient conditions are sustained in at least the western portion of the cross-section after the tributaries mix together.

Based on this collected data, we request that the proposed thermal limits on the Sanitary District's discharge be waived.

If you have any comments or questions, please call Joe at (262) 204-2349.

Sincerely,

CEDAR CORPORATION

Joseph M. Martirano, P.E.
Project Engineer

Dean P. Zanon, P.E.
President

JMM/cap

Enclosures (9):

Attachment 1: Raw Collected Data from November 3, 2020.
Figure 1: Supplemental Monitoring Point Locations.
Figure 2: November 3, 2020, Profile – Surface Temperatures + Conductivity.
Figure 3: November 3, 2020, Profile – Bottom of Creek Temperatures + Conductivity.
Photo 1: At WWTP Outfall Looking Towards 50 LF Upstream Monitoring Point.
Photo 2: Upstream Monitoring Location, Looking Downstream at WWTP Outfall and Tributary Split.
Photo 3: Creek Cross-section at WWTP Outfall.
Photo 4: Creek Cross-section at 50 LF Downstream Monitoring Location of WWTP Outfall.
Photo 5: 125 LF Downstream Monitoring Location, Looking Upstream Towards WWTP Outfall and Tributary Split.

CC: Roy Van Gheem, Wastewater Engineer, WDNR–Green Bay Service Center (one copy; e-submittal: Roy.VanGheem@wisconsin.gov)
Terri Romitti, Freedom Sanitary District No. 1 (two copies; TRomitti@freedomsanitary.org)

Freedom Sanitary District No. 1

Dissipative Cooling: Request for Additional Data

Attachment 1 - Raw Collected Data from November 3, 2020

Sampling Date: November 3, 2020

WWTP Effluent Temperature (°F): 51.5

Ambient Air Temperature (°F): 54

Monitoring Location	Lateral Stream Location	Surface or Bottom	Temperature (°F)	Conductivity (mS/m)
1 (50 LF upstream of WWTP outfall)	E	S	38.3	996
	M	S	38.5	1,001
	W	S	38.7	998
	E	B	38.3	1,004
	M	B	38.5	1,000
	W	B	38.7	778
2 (At WWTP outfall)	E	S	46.9	1,460
	M	S	38.5	916
	W	S	38.5	997
	E	B	45.1	1,368
	M	B	38.5	999
	W	B	38.5	994
3 (50 LF downstream of WWTP outfall)	E	S	45.5	1,260
	M	S	45.0	1,245
	W	S	43.3	1,201
	E	B	45.5	1,260
	M	B	Surface Reading	Surface Reading
	W	B	Surface Reading	Surface Reading
4 (75 LF downstream of WWTP outfall)	E	S	44.78	1,258
	M	S	45.32	1,220
	W	S	45.68	1,241
	E	B	Surface Reading	Surface Reading
	M	B	Surface Reading	Surface Reading
	W	B	Surface Reading	Surface Reading
5 (125 LF downstream of WWTP outfall)	E	S	44.6	1,220
	M	S	38.7	1,015
	W	S	38.5	994
	E	B	Surface Reading	Surface Reading
	M	B	Surface Reading	Surface Reading
	W	B	Surface Reading	Surface Reading

Note:

Upstream mouth of northwest tributary (near WWTP outfall) measured at 38.7°F and 995 mS/m.

Downstream mouth of northwest tributary (near 100 LF downstream) measured at 38.5°F and 1,005 mS/m.

Abbreviation Designations:

E - Data collected 5 feet from East Bank of Duck Creek

M - Data collected from middle of Duck Creek

W - Data collected from West Bank of Duck Creek

S - Data collected from surface of Duck Creek

B - Data collected from bottom of Duck Creek

DRAWN BY
JMM
DATE
NOV 2020
REFERENCE FILE
DRAWING FILE

DISSIPATIVE COOLING STUDY
SUPPLEMENTAL MONITORING POINT LOCATIONS

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FIGURE
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Figure 2: November 3, 2020 Profile - Surface Temperatures + Conductivity

NOTE: WWTP Effluent Temperature measured at 56°F, Ambient Air Temperature measured at 42°F

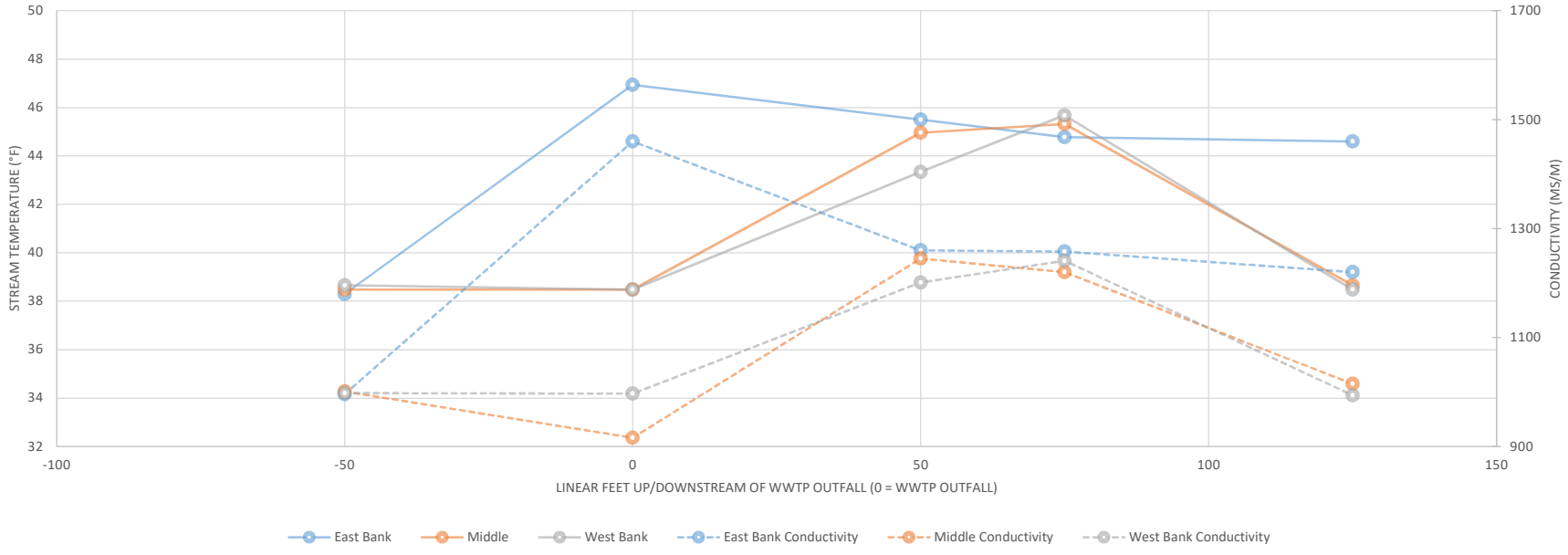

Figure 3: November 3, 2020 Profile - Bottom of Creek Temperatures + Conductivity

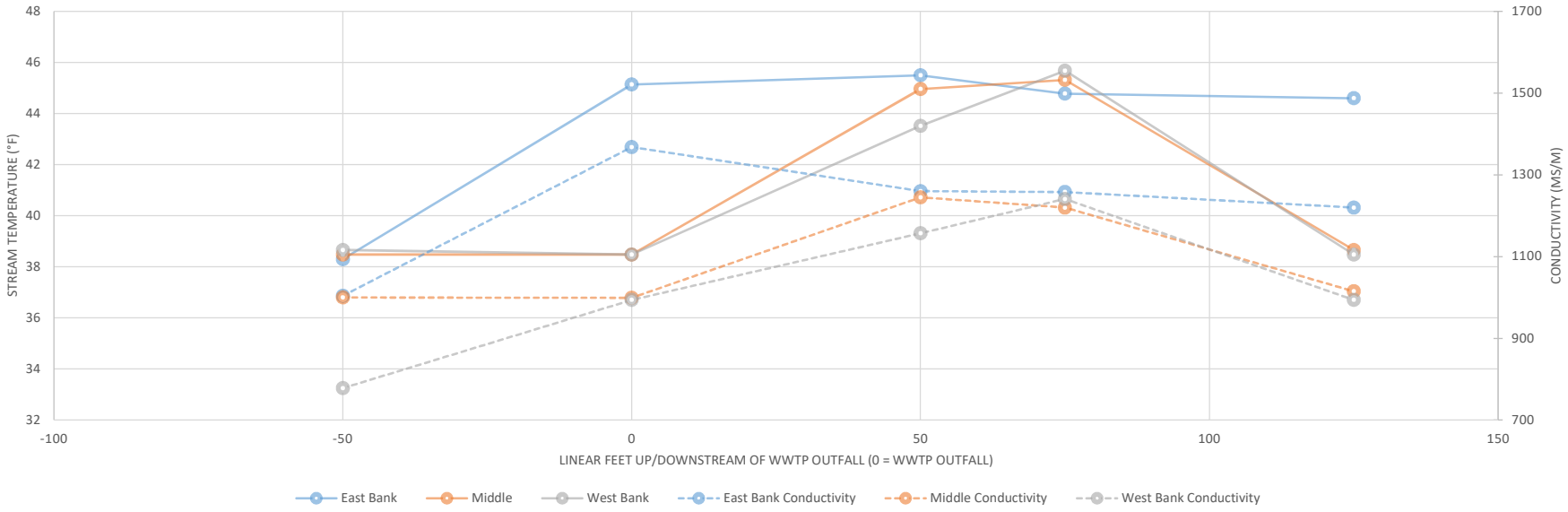


Photo 1: At WWTP Outfall Looking Towards 50 LF Upstream Monitoring Point
Point MP 1-E-S:
Temperature: 38.3 °F
Conductivity: 996 mS/m
Point MP 1-M-S:
Temperature: 38.5 °F
Conductivity: 1,001 mS/m
Point MP 1-W-S:
Temperature: 38.7 °F
Conductivity: 998 mS/m


Photo 2: Upstream Monitoring Location, Looking Downstream at WWTP Outfall and Tributary Split
Mouth of West Tributary around island:
Temperature: 38.7 °F
Conductivity: 995 mS/m
Point MP 2-W-S:
Temperature: 38.5 °F
Conductivity: 997 mS/m
Point MP 2-M-S:
Temperature: 38.5 °F
Conductivity: 916 mS/m
Point MP 2-E-S:
Temperature: 46.9 °F
Conductivity: 1,460 mS/m

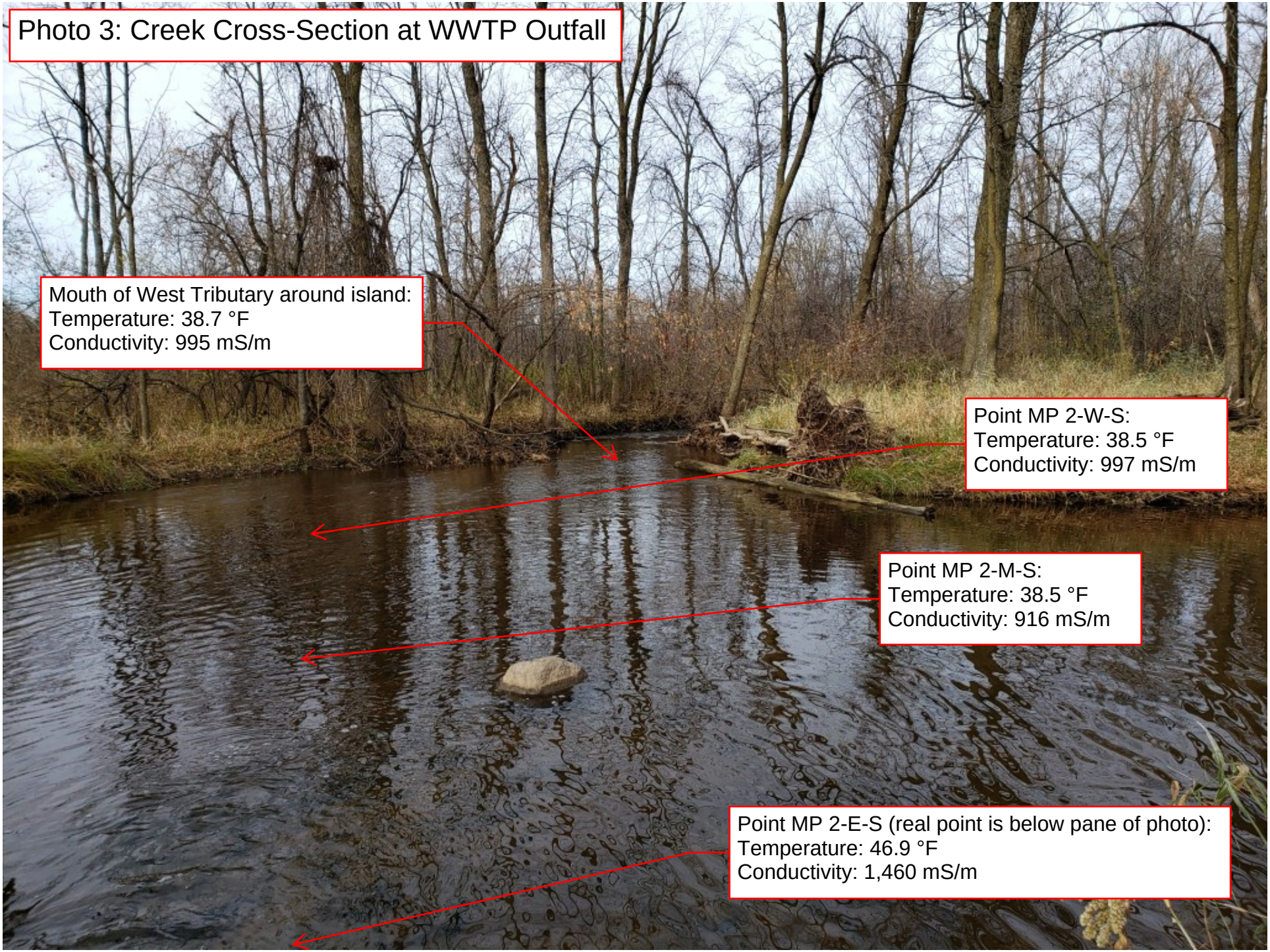
Photo 3: Creek Cross-Section at WWTP Outfall
Mouth of West Tributary around island:
Temperature: 38.7 °F
Conductivity: 995 mS/m
Point MP 2-W-S:
Temperature: 38.5 °F
Conductivity: 997 mS/m
Point MP 2-M-S:
Temperature: 38.5 °F
Conductivity: 916 mS/m
Point MP 2-E-S (real point is below pane of photo):
Temperature: 46.9 °F
Conductivity: 1,460 mS/m

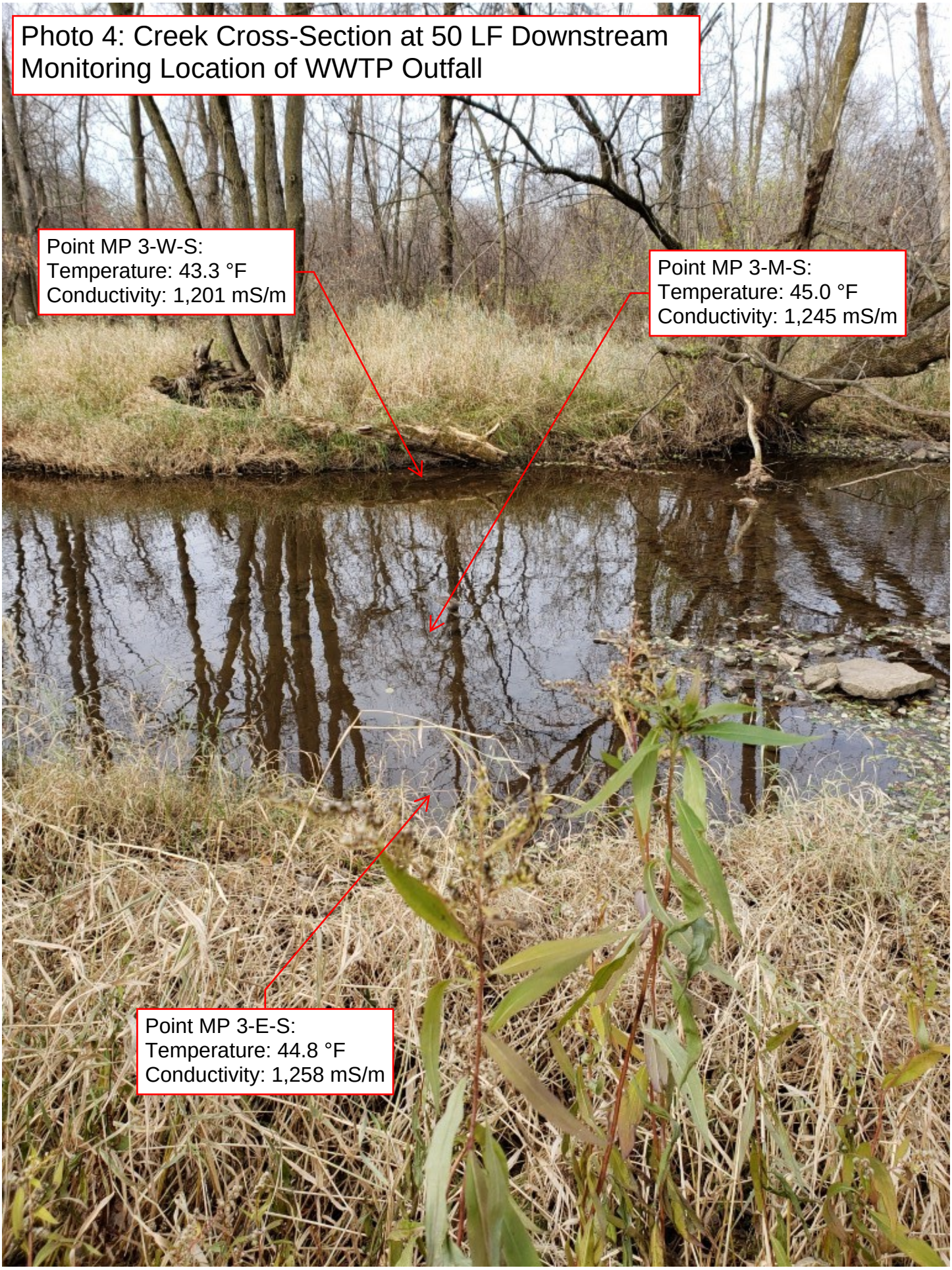
Photo 4: Creek Cross-Section at 50 LF Downstream Monitoring Location of WWTP Outfall
Point MP 3-W-S:
Temperature: 43.3 °F
Conductivity: 1,201 mS/m
Point MP 3-M-S:
Temperature: 45.0 °F
Conductivity: 1,245 mS/m
Point MP 3-E-S:
Temperature: 44.8 °F
Conductivity: 1,258 mS/m

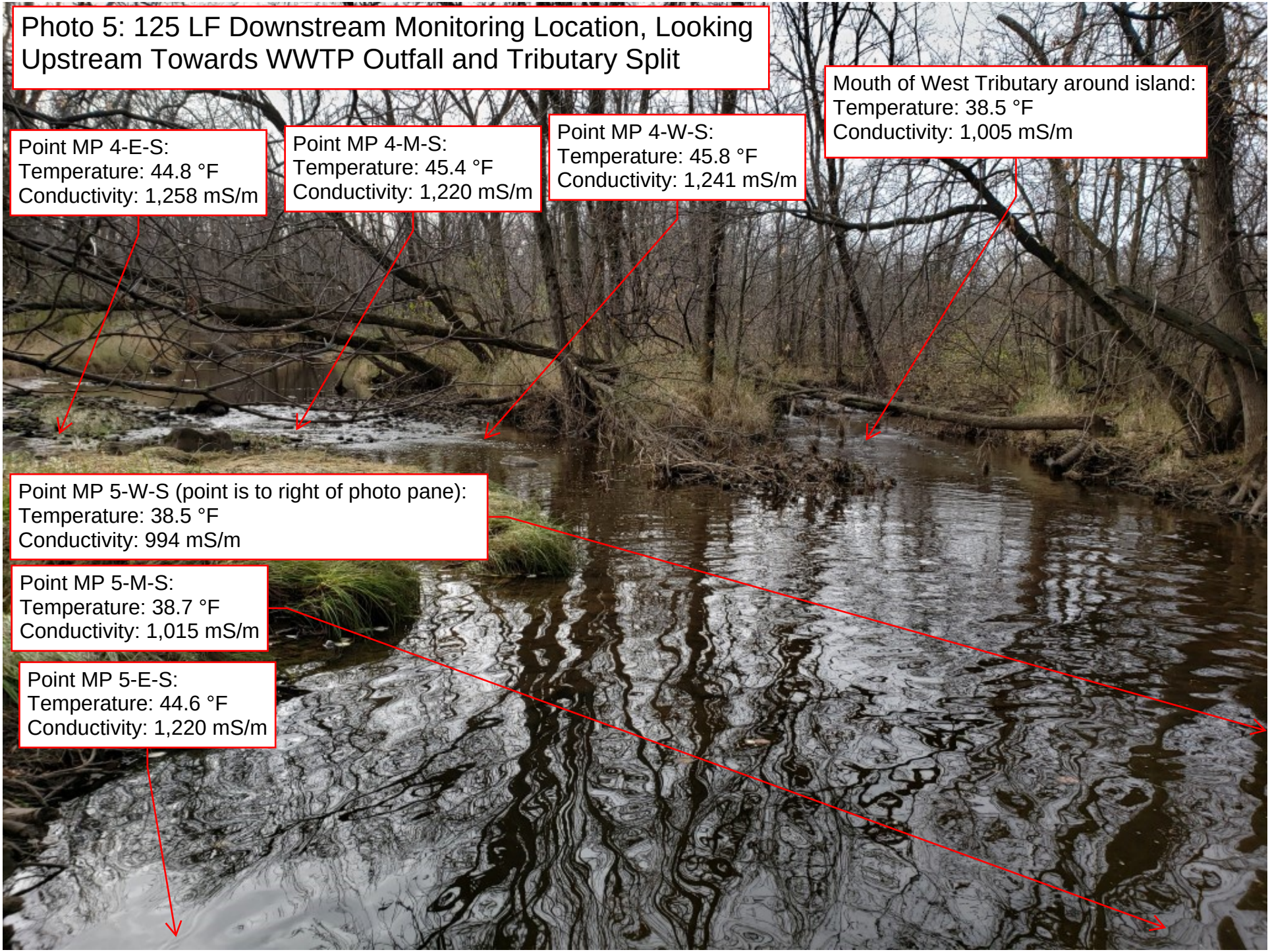
Photo 5: 125 LF Downstream Monitoring Location, Looking Upstream Towards WWTP Outfall and Tributary Split
Point MP 4-E-S:
Temperature: 44.8 °F
Conductivity: 1,258 mS/m
Point MP 4-M-S:
Temperature: 45.4 °F
Conductivity: 1,220 mS/m
Point MP 4-W-S:
Temperature: 45.8 °F
Conductivity: 1,241 mS/m
Mouth of West Tributary around island:
Temperature: 38.5 °F
Conductivity: 1,005 mS/m
Point MP 5-W-S (point is to right of photo pane):
Temperature: 38.5 °F
Conductivity: 994 mS/m
Point MP 5-M-S:
Temperature: 38.7 °F
Conductivity: 1,015 mS/m
Point MP 5-E-S:
Temperature: 44.6 °F
Conductivity: 1,220 mS/m